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Weekly Bulletin

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Virulence Tests for Diphtheria

By W. H. KELLOGG, M.D., Chief, Division of Laboratories.

The question of the need for and value of virulence tests on throat cultures from diphtheria carriers in the administrative control of diphtheria is one that is frequently asked of health officers. From the bacteriological standpoint, the following statements may apply.

When people have recovered from diphtheria they sometimes continue to yield positive cultures for several weeks or months and are therefore classed as carriers and must be considered as a potential danger in the community, the same as an acute case of diphtheria. Owing to the fact that inoculations of these cultures into guinea pigs result in a definite reaction in the skin when virulent diphtheria bacilli are present and owing to the fact that it is sometimes found that such inoculations do not have this effect after the carrier period has continued for a considerable time, it has become the practice to make such virulence tests in order to find out if the person is harboring a virulent strain of the diphtheria bacillus or one that is so lacking in virulence and toxic power that it does not affect the guinea pigs and is therefore, presumably, no longer a danger to the community. A carrier who in this way is found to be nonvirulent is therefore considered to be safe for release from quarantine.

In actual practice the matter is not quite so simple as the above would indicate for the reason that like the process of obtaining negative cultures for release from quarantine there is a likelihood of alternating positive and negative results because of varying conditions associated with each separate culturing of the patient. These varying conditions in the case of alternating positive and negative cultures concern such things as a change in ratio between the proportion of diphtheria bacilli and other organisms, in the throat, the diphtheria bacilli becoming scarcer as time goes on, which results in some cultures appearing negative, whereas in fact there were a few bacilli that escaped observation, and in the next culture the ratio may be sufficiently changed so that they are again discovered.

A similar condition exists in virulence tests; there may be so few diphtheria bacilli that the guinea pig is not affected and in the next test there may be more, resulting in a positive test. In the case of virulence tests the matter is still further confused by the existence of diphtheroids which look exactly like diphtheria bacilli under the microscope but which are not true diphtheria bacilli and do not give positive diphtheria virulence tests. The balance existing between the true and the false, therefore, may be so finely adjusted as to give variable results. In the main, however, and in everyday practice these things may be ignored because ordinarily when a virulence test is negative the reason for this result is that the

diphtheria bacilli seen in the cultures were not diphtheria bacilli at all.

This brings up the old question of whether we actually have nonvirulent but nevertheless true diphtheria bacilli or whether all nonvirulent diphtheria-like organisms are in fact not diphtheria bacilli, but diphtheroids. The prevailing opinion among bacteriologists is that the latter is usually true. The existence and frequent occurrence of these diphtheroids, which look exactly like diphtheria bacilli, would be so reported under the standard procedure of examining cultures. Therefore a more frequent use of virulence tests in the release of supposed diphtheria carriers should prevail.

Diphtheroids are much more likely to be found in carriers who have not themselves had diphtheria, but have possibly been in contact with cases and sometimes without any known contact, such as carriers picked up in the course of a school survey or preceding entrance into an institution of some kind. The majority of such carriers, which are called casual carriers—that is, people who have had no known contact with diphtheria, are nonvirulent and should have the benefit of the virulence test with immediate release from quarantine if the test is negative.

The carrier who is almost certain to be virulent is the recently recovered case. For this reason departments of health usually do not apply the virulence test to recovered cases in less than two months from recovery.

To sum up the situation: diphtheria carriers should be grouped into two classes, convalescent, who are always virulent and a great potential danger, and chronic, who may or may not be virulent. The lack of virulence of the culture that exists in nonvirulent (harmless, and therefore not true carriers) may be due to an actual weakening in the toxin producing power of the diphtheria bacilli, but it is more likely to be due to the fact that the organism concerned is not the diphtheria bacillus at all, the latter having disappeared completely and having been replaced by diphtheroids which are organisms that look like diphtheria bacilli but are not. The application of the virulence test is always in order and is the most just and proper procedure for persons who are "casual" carriers. The virulence test, on the other hand, is not indicated for carriers who are recent convalescents.

"If you hear about a thing you soon forget it;
If you see it done you remember half of it;
If you do it yourself you remember it all."

—Chinese Proverb.

THE CHEMIST'S ROLE IN AN INDUSTRIAL HYGIENE PROGRAM

By Wesley J. Roberts, B.S., Ch.E., Chemist Industrial Hygiene Service, California State Department of Public Health.

A potential occupational health hazard, in the eyes of an industrial hygienist, exists if an industrial worker is exposed to a substance, which, coming in contact with, or taken into the body, may have a detrimental effect on the worker's health.

Cooperating with the physician and the engineer, the chemist makes laboratory studies of gases, dusts, fumes and other potentially dangerous substances collected in the workroom environment. From his studies the physician and the engineer are able to determine the seriousness of the exposure. In a great many instances, the amounts of toxic materials present are so small that they can be determined accurately only by careful chemical analyses.

The scientific instruments and indicators available for making field tests of atmospheres and environmental conditions are invaluable to the industrial hygienist because of their portability, ease of operation, and the speed of obtaining results; but these instruments are usually limited in their scope. They are not sufficiently accurate to measure some of the gases, vapors or fumes having a low toxic threshold, and their readings must be occasionally checked by chemical analysis to be sure they are working properly and are giving a true picture of conditions. Then, too, the industrial worker is often exposed to a material for which there is no field indicator available. It is then the chemist's duty to collect and analyze a sample of this material in order to determine the degree of health hazard involved.

Many industrial poisons are introduced into the body through the lungs in the process of breathing. This calls for a study of the processes involved, the materials handled, and an analysis of the air breathed. Fumes and vapors and some gases are collected by passing a measured volume of air, obtained at the worker's breathing level, through some absorbent which will remove the toxic material in such a way that its quantity can be determined. Gravimetric, volumetric colorimetric, and electrolytic methods may be used in the analysis, depending on the nature of the material collected and the degree of accuracy required in the results.

In the case of a gaseous mixture, a sample of the air is taken and the constituents determined by a systematic measurement of changes of gas volume after subjecting the sample to treatment with suitable absorbents, in the case of carbon dioxide, carbon monoxide, oxygen, and illuminants; or by subjecting

the mixture to combustion with oxygen, in the case of methane, ethane, and hydrogen.

The gases and vapors encountered in industry vary in degree of toxicity from carbon dioxide, which needs to be considered as a potential health hazard only if 2 per cent or more is present, to phosgene, which is dangerous in a concentration of one part in a million parts of air breathed. There are other gases even more toxic than phosgene. Thus the methods used in air analysis must be capable of considerable adaptability.

In the case of dusty atmospheres, the dust in a measured volume of air is collected by means of the impinger dust sampling apparatus. The dust particles are then counted and measured, and the percentage of material dangerous to health is estimated by chemical and optical methods.

Thus, the work of the chemist is essential in industrial hygiene, not only to determine the location and degree of occupational hazards, but also, with the data obtained under actual operating conditions, coupled with the physician's clinical examinations of the workers, to furnish more definite information on the effects on the human system of small concentrations of various gases, vapors, and dusts.

HUMAN PSITTACOSIS CAUSED BY PETRELS OR FULMARS ON THE FAROE ISLANDS

By K. F. Meyer, M.D., from the George Williams Hooper Foundation, University of California, San Francisco, Calif.

Since 1930 a peculiar epidemic type of pneumonia attracted the attention of the local physicians (A. A. Rasmussen and R. K. Rasmussen-Ejde). At least 174 cases of this disease have been observed. As a rule, the onset of the malady was sudden accompanied by high fever, headache, general malaise, pain and nausea; the fever was continuous and showed a lytic decline in the third to fifth week. The patients were very ill and the course was typhoid-like. Migrating pulmonary infiltrations with fine crepitant respiratory sounds without cough or sputum accompanied the fever. Bradycardia and constipation were frequently seen. The sedimentation reaction was increased. A slight leucocytosis was recorded in a few cases.

The disease is confined to the season—August till September—and is principally seen in women (86 per cent). The mortality was approximately 19.5 per cent but varied in the different years between 11.3 to 44.0 per cent. The immunity is a relative character; second attacks within 1 to 2 years have been seen in 2 patients. The Faroe disease is intimately connected with the handling of the arctic fulmars (*Fulmarus glacialis*). The young fat birds are caught (80 to 100,000 annually), cleaned, cooked and used as food or they are pickled. In recent years many of the young birds were found to be emaciated. Many of the women who contracted the disease had picked the feathers of the fulmars and fell ill within 6 to 12 days. This form of handling seems to be particularly hazardous, since the catching and evisceration of the birds is done by the male population who were only slightly affected. It is not unlikely that the desiccated faecal material on the feathers is highly infectious. Adult fulmars are caught during the winter months but have caused no human illness. Just as the immature shell parrakeet is the main source of human psittacosis so is the young fulmar the principal disseminator of the disease agent. Again, the avian disease is a nest infection. Haagen, Mauer and Bedson have conclusively proven that the infection on the Farroe Islands is psittacosis. The virus was not only isolated from the blood and organs of patients but also from the spleen and liver of several fulmars. It produced typical lesions in mice and infected shell parrakeets. The serum of three convalescent patients gave specific complement fixation reactions.

Thus the importance of nontropical psittacine birds as sources of human psittacosis is again emphasized. That finches and canaries may be carriers is well known. One is now confronted with the pertinent question: How many other species of birds may suffer from psittacosis? The Pacific fulmar occurs on the coast of California; it associates with sea gulls. Are they infected? This is only one of the many pertinent epidemiologic questions which may now be asked.

The ingredients of health and long life are great temperance, open air, easy labor, and little care.—Sir P. Sidney.

MORBIDITY

Complete Reports for Following Diseases for Week Ending February 4, 1939

Chickenpox

790 cases: Alameda County 26, Alameda 4, Berkeley 13, Hayward 3, Oakland 15, Pleasanton 3, San Leandro 3, Jackson 1, Chico 1, Contra Costa County 8, Fresno 25, Sanger 1, Eureka 1, Brawley 3, Calexico 1, El Centro 1, Calipatria 1, Kern County 5, Lemoore 8, Lake County 1, Los Angeles County 82, Alhambra 7, Arcadia 4, Beverly Hills 1, Burbank 1, Glendale 5, Huntington Park 2, Inglewood 3, Long Beach 5, Los Angeles 91, Monrovia 11, Pasadena 15, Pomona 2, San Marino 4, Santa Monica 3, Whittier 3, South Gate 10, Signal Hill 1, Maywood 2, Madera County 11, Chowchilla 3, Corte Madera 1, Mill Valley 27, San Anselmo 1, Mendocino County 1, Ukiah 3, Merced County 15, Monterey County 1, Monterey 2, Napa County 1, Grass Valley 2, Orange County 10, Anaheim 6, Brea 1, Santa Ana 5, Riverside County 1, Banning 4, Beaumont 1, Corona 6, Indio 1, Sacramento County 1, Sacramento 12, San Bernardino County 4, San Diego County 6, Chula Vista 3, La Mesa 1, Oceanside 2, San Diego 21, San Francisco 44, San Joaquin County 33, Lodi 21, Stockton 4, Tracy 23, San Mateo County 1, Daly City 4, Redwood City 1, San Mateo 6, Santa Barbara County 3, Santa Barbara 7, Santa Clara County 22, Mountain View 1, Palo Alto 1, San Jose 7, Santa Cruz County 3,

Santa Rosa 2, Stanislaus County 2, Modesto 2, Oakdale 28, Tehama County 3,, Red Bluff 5, Tulare County 5, Porterville 1, Santa Paula 5, Yolo County 8, Antioch 10, Concord 2, Fresno County 7.

Diphtheria

37 cases: Oakland 2, Concord 1, Bakersfield 1, Los Angeles 20, Ukiah 1, Atwater 1, Carmel 1, Napa 1, Orange County 1, San Bernardino County 1, Ontario 1, San Bernardino 1, San Diego 1, San Francisco 2, Santa Rosa 1, Yuba County 1.

German Measles

33 cases: Alameda 3, Berkeley 6, Oakland 3, Fresno 1, Bakersfield 1, Los Angeles County 1, Los Angeles 3, South Pasadena 1, Orange County 1, Riverside 1, San Bernardino County 6, Ontario 1, San Diego County 2, San Francisco 1, San Mateo 1, Santa Clara County 1.

Influenza

95 cases: Oakland 1, Fresno County 1, Kern County 1, Los Angeles County 2, Glendale 5, Long Beach 2, Los Angeles 16, Madera County 2, Mariposa County 1, Yosemite National Park 3, Roseville 29, San Diego 2, San Francisco 3, Stockton 1, San Jose 1, Tehama County 5, Corning 19, Ventura County 1.

Measles

2239 cases: Alameda County 95, Alameda 49, Albany 8, Berkeley 134, Hayward 15, Oakland 299, Piedmont 4, Pleasanton 1, San Leandro 48, Chico 1, Contra Costa County 31, Antioch 1, El Cerrito 30, Martinez 1, Pinole 1, Pittsburg 38, Richmond 40, Fresno County 11, Fresno 26, Calipatria 2, Inyo County 1, Lake County 1, Los Angeles County 19, Alhambra 1, Burbank 4, Glendale 3, Inglewood 1, Long Beach 40, Los Angeles 90, Montebello 2, Redondo 1, South Pasadena 1, Madera County 8, Marin County 9, Mill Valley 2, San Anselmo 27, San Rafael 3, Sausalito 2, Mariposa County 3, Mendocino County 18, Monterey 1, Orange County 7, Orange 1, Santa Ana 1, Laguna Beach 1, Riverside County 50, Banning 2, Perris 2, Riverside 28, Sacramento County 8, Sacramento 25, North Sacramento 3, San Bernardino County 24, Ontario 1, San Bernardino 1, National City 1, San Diego 30, San Francisco 413, San Joaquin County 17, Stockton 27, San Luis Obispo County 5, Paso Robles 1, San Mateo County 14, Burlingame 10, Daly City 23, Hillsborough 1, Redwood City 12, San Bruno 11, San Mateo 16, South San Francisco 5, Atherton 1, Menlo Park 4, Belmont 1, Santa Barbara County 1, Santa Clara County 119, Gilroy 1, Los Gatos 1, Palo Alto 7, San Jose 141, Santa Clara 8, Sunnyvale 1, Santa Cruz County 3, Watsonville 8, Siskiyou County 30, Solano County 15, Benicia 2, Fairfield 3, Suisun 1, Vallejo 3, Sonoma County 11, Petaluma 1, Santa Rosa 4, Stanislaus County 17, Modesto 1, Tehama County 33, Corning 6, Red Bluff 1, Yuba County 3.

Mumps

886 cases: Alameda County 13, Alameda 8, Albany 20, Berkeley 108, Hayward 2, Livermore 1, Oakland 85, Piedmont 9, San Leandro 15,, Contra Costa County 19, El Cerrito 10, Martinez 1, Pittsburg 1, Richmond 7, Walnut Creek 13, Fresno County 1, Fresno 5, Calexico 8, Kern County 45, Bakersfield 3, Los Angeles County 12, Alhambra 1, Beverly Hills 1, Glendale 1, Long Beach 2, Los Angeles 31, Manhattan 1, Monrovia 2, Pasadena 2, San Marino 3, Santa Monica 2, Sierra Madre 2, South Pasadena 2, Lynwood 8, Madera County 2, Chowchilla 1, Mill Valley 1, Yosemite National Park 1, Mendocino County 15, Ukiah 1, Merced County 18, Gustine 11, Monterey County 1, Monterey 1, Orange County 3, Santa Ana 4, Roseville 4, Plumas County 1, Riverside County 4, Riverside 19, Sacramento County 50, Sacramento 54, San Bernardino County 9, Ontario 8, San Diego County 8, Chula Vista 1, San Diego 14, San Francisco 34, San Joaquin County 43, Manteca 1, Stockton 21, San Luis Obispo 5, San Mateo County 2, Burlingame 3, San Mateo 1, Santa Barbara County 1, Santa Barbara 2, Santa Clara County 10, Palo Alto 1, San Jose 2, Santa Cruz County 43, Benicia 1, Rio Vista 2, Vallejo 4, Sonoma County 2, Stanislaus County 3, Modesto 3, Tehama County 2, Trinity County 1, Tulare County 12, Porterville 2, Visalia 1, Tuolumne County 1, Ventura County 2, Ventura 1, Davis 1, Woodland 4.

Pneumonia (Lobar)

95 cases: Alameda 1, Berkeley 1, Oakland 3, Butte County 1, Humboldt County 3, Imperial County 2, Los Angeles County 5, Azusa 2, Claremont 1, Glendale 3, Long Beach 6, Los Angeles 23, Pasadena 2, Redondo 1, Monterey Park 1, Madera County 1, Napa County 1, Orange County 2, Laguna Beach 1, Placer County 2, Riverside 1, Sacramento County 1, Sacramento 3, San Bernardino County 3, La Mesa 1, San Diego 2, San Francisco 6, San Joaquin County 4, Stockton 2, San Luis Obispo County 1, Lompoc 1, Vallejo 1, Sonoma County 1, Stanislaus County 2, Corning 1, Yolo County 1, Woodland 1, Yuba County 1.

Scarlet Fever

239 cases: Berkeley 2, Oakland 2, Amador County 1, Jackson 1, Contra Costa County 2, Martinez 1, Fresno County 3, Fresno 5, Eureka 1, Inyo County 1, Kern County 1, Bakersfield 1, Taft 1, Kings County 1, Hanford 2, Los Angeles County 28, Alhambra 2, Beverly Hills 1, Glendale 5, Long Beach 6, Los Angeles 56, Redondo 2, San Gabriel 1, Santa Monica 3, Whittier 1, Lynwood 1, Hawthorne 1, Monterey Park 2, Mendocino County 1, Santa Ana 2, Placentia 3, Plumas County 1, Riverside County 3, Corona 3, Elsinore 1, Hemet 1, Riverside 1, Sacramento County 1, Sacramento 3, San Bernardino County 1, Ontario 1, San Bernardino 1, San Diego County 1, Chula Vista 5, San Diego 2, San Francisco 21, San Joaquin County 6, Lodi 2, Manteca 1, Stockton 1, San Mateo County 3, Hillsborough 1, Santa Barbara County 1, Santa Barbara 4, Los Gatos 6, Palo Alto 1, San Jose 4, Santa Cruz County 4, Stanislaus County 1, Modesto 5, Sutter County 1, Tehama County 3, Red Bluff 3, Tulare County 2, Ventura 1, Yuba County 1, California 2.*

Smallpox

11 cases: Fresno County 2, Long Beach 2, Los Angeles 1, Sacramento 6.

Typhoid Fever

4 cases: Los Angeles 2, Whittier 1, Tulare County 1.

Whooping Cough

131 cases: Albany 1, Berkeley 1, Oakland 1, Fresno County 4, Kern County 1, Susanville 4, Los Angeles County 6, Long Beach 4, Los Angeles 26, Pasadena 2, Redondo 2, Bell 3, Gardena 3, San Rafael 1, Orange County 2, Fullerton 3, Santa Ana 11, San Diego 4, San Francisco 12, San Joaquin County 2, San Mateo 2, Santa Clara County 1, San Jose 9, Solano County 1, Vallejo 1, Santa Rosa 5, Stanislaus County 4, Corning 1, Tulare County 1, Ventura County 4, Yolo County 3, Yuba County 6.

Meningitis (Epidemic)

1 case: Eureka.

Dysentery (Amoebic)

13 cases: Amador County 1, Fresno County 1, Long Beach 2, San Bernardino County 3, San Bernardino 2, National City 1, San Francisco 1, Santa Barbara 1, Ventura 1.

Dysentery (Bacillary)

5 cases: Calipatria 1, Los Angeles 1, Sonoma County 3.

Pellagra

1 case: San Francisco.

Tetanus

1 case: Orange County.

Trachoma

15 cases: Berkeley 1, Los Angeles County 1, Orange County 2, Indio 9, San Jose 1, Tulare County 1.

Beriberi

1 case: San Francisco

Paratyphoid Fever

1 case: Los Angeles

Typhus Fever

1 case: San Diego.

Food Poisoning

92 cases: Los Angeles 35, Orange 39, San Francisco 18.

Undulant Fever

5 cases: Glendale 1, San Bernardino County 1, Santa Barbara County 1, Sonora 1, Marysville 1.

Septic Sore Throat

2 cases: Oakland 1, San Diego 1.

Rabies (Animal)

30 cases: Imperial County 2, Kern County 3, Bakersfield 3, Kings County 1, Los Angeles County 3, Compton 1, Los Angeles 3, Manhattan 1, Monrovia 1, Redondo 1, Monterey 2, San Francisco 1, San Joaquin County 1, Santa Clara County 5, Stanislaus County 1, Modesto 1.

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* Cases charged to "California" represent patients ill before entering the state or those who contracted their illness traveling about the state throughout the incubation period of the disease. These cases are not chargeable to any one locality.

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